Framework of the Blended Learning in Vocational Study to Achieve Hot Skills

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Abstract— **This study aims to find and test learning frameworks that are suitable to be applied in Geomatics material at the university level. The method used was descriptive qualitative, with the participation of 32 students who were given mixed learning through a model, method, and evaluation. Data collection is done through literature studies to determine the greatness of the mixed learning framework. The proposed conceptual framework was then tested for efficacy through interviews, questionnaires and online-based learning achievements. The results showed that by applying mixed learning, student achievement at the HOTS (C4-C6) level reached an average value of 82. 69 with a standard deviation of 10.45. But on digital-based online exams, only 19 students (59.38%) were successful online with an average score of 67.38 with a standard deviation of 6.25. Based on the results of the student's achievement, it can be concluded that in face-to-face learning, students have got HOTS according to the standard. But in online learning students still, need habituation so that discipline is formed in digital online treatment. Further, The investigation proposed that lecturers should prepare instructional designs in a blended manner.**

Keywords— Blended learning, Instructional Design, HOT Skills.

I. INTRODUCTION

Work competition in the 21st-century, in addition to computers and machines, requires more resources that have high-level thinking skills (HOTS), compared to workers who only have regular knowledge and basic skills. Industrial competition is no longer only in the national but global competition scope [1]. To meet the new paradigm, constructivist learning becomes a basic requirement in learning. Constructivism develops from the theoretical concept gradually to application and is combined with the use of ICT, [2]. The Assessment and Teaching of 21st - Century Skills [3]. "COMPETENCIES," (2016) divides 21st -century competencies into 1) ways of thinking, 2) how to work, and 3) work tools including information literacy, information and communication (IT), and literacy technology. ICT is very closely related to the needs of students who follow the trend of the progress of the era/ the millennial (Y-gen), especially with the development of recent internet progress. E-learning is an electronic media and Information and Communication Technology (ICT), including various forms of learning technology [4].

The results of Wannapiroon's research in 2014 [5] show that e-learning is a facility that helps students to be able to study anywhere, anytime, and this is very compatible with constructivist theory. [6] Mayer's research et al. (2013) regarding face-to-face versus online learning indicate that online discussions trigger students to use high-order thinking (HOT).

The use of technology in effective learning not only provides computers and connects to the internet [7], but also emphasizes the same responsibility between lecturers and students in the transfer of knowledge [8]. One of them is the advancement of technology and the current state of education leading to electronic learning or e-learning, which is now successfully used in many countries to train future professionals in higher education and for corporate training [9].

Various online-based models (LMS) can be applied in learning according to Allen, et.al (n.d.) [10] classifies learning as follows: a) learning is called face-to-face if it uses the web between 0-29%, b) it is blended learning if using the web between 30-79% and c) it is online learning if using the web between 80-100%. [11] and [12] stated that distance learning (e-learning) especially using mobile devices can increase and precipitate knowledge and promote broad access to increase student participation. Blended learning integrates web learning with face-to-face learning oriented to the activities, assignments, discussions, presentations, evaluations, and feedback [13]. The opinions of the experts/ researchers about the use of ICT in learning above can provide an illustration of the importance of ICT to support the learning process and outcomes of the students in using high-order thinking skills (HOTS) to compete in the global workforce.

In teaching and learning context, mobile devices allow teachers and students to overcome the limitations of time and physic of classes because information is everywhere and no longer limited to certain times and places for learning [14]. Innovation is also a necessity for lecturers to develop media in accordance with the students' willingness to study online. In the present era, blended learning has become the most preferred media for students [15]. In this research, the researcher chose Edmodo application to do blended learning in Geomatics course.

In relation to the field of the research (Geomatics), currently, it plays an important role in providing supporting data for fast, accurate and broad planning and as a major need for the construction industry. Development in all civil fields such as buildings, highways, dams, airports, etc. will not be separated from map-based planning. The current development of education and industry that requires the speed of information makes ICT-based learning become a basic requirement, which allows teachers and students to take information outside of textbooks to collaborate with people in the distance and to access the actual audience outside the classroom [16].

Unfortunately, the problem of blended learning still occurs in the classroom, especially in the Geomatics subject. Some instructors were allegedly not designing and implementing ICT-based mixed learning that has become an institutional policy, making it difficult for students to get high-level thinking skills (HOTS).

ICT-based instructional development is not solely the responsibility of lecturers but also of institutions, universities, and stakeholders [17]. Collaboration between institutions and lecturers in the use of ICT is an extraordinary synergy in realizing learning objectives. The institution that the researcher is affiliated to, Sebelas Maret University, has required lecturers to prepare learning instruments one step ahead by implementing ISO 9001 based learning instruments [18]. ISO 9001 facility is one of the requirements for lecturer readiness in the learning process. Other facilities provided in supporting e-learning are such as Academic Information Systems (SIAKAD), mobile presence, and applications for Open Course Ware (OCW) online learning that must be applied by lecturers by applying ICT on the lecturer performance. Furthermore, for online facilities for students, the campus has provided adequate wifi through laptops and mobile phones that all students must have. Thus, they can use it freely in supporting learning. To complete a more professional online blended learning, the researcher chooses the Edmodo learning application in the Geomatics/ Surveying and Mapping 1.

1. Learning to Enhance High-Order Thinking Skills (HOTS)

High-order thinking skills (HOTS) are thinking activities involving cognitive levels (C4-C6) from the high hierarchy of thinking taxonomy [19]. It is inevitable that developing high-order thinking skills in students is important, but, for this to happen, teachers need to acquire and practice these skills [20]. In contrast to general research that makes students the object of learning, the modern learning approach places student achievement in the center of development and quality assurance [21]. This is because learning objectives with high-order thinking skills (HOTS) will prepare students for success in a challenging real-world today [8] .

2. How to realize HOTS in learning?

Many teachers feel that they have given high-level thinking to students even though this has not happened [22]; The answer to the question about how to realize HOTS is to integrate the model, which in this study the model applied is an integrated model of scaffolding-Problem Based Learning (SCF-PBL). With the integration of this model, the purpose of the research is to obtain 21st-century high-level thinking skills, namely ICT-based competencies. [23] states that scaffolding assistance has visible characteristics, namely: 1) simplifying tasks, 2) giving instructions to students in achieving goals, 3) demonstrating and describing ideally the activities to be carried out.

The Problem Based Learning (PBL) model views knowledge to be better if it is built through strengthening problems and in situations of the good social environment [24]. In this fast-changing era, learners must be directed towards real problems in the field, [25] . The problem-based learning (PBL) approach is a learning concept that helps teachers create a learning environment that starts with important and relevant (relevant) problems for students and allows students to gain more realistic learning experience. From the results of the expert studies above, the researcher reviewed the advantages of the face-to-face learning model, blended learning and online learning in the formation of HOTS in students as Table 1.

TABLE I. OVERVIEW OF SELECTING BLENDED LEARNING IN GEOMATICS STUDY

No	The Researcher	Face-to-face Learning	Blended Learning	Online Learning
(a)	(b)	(c)	(d)	(e)
1	[17]	If the support of institutions and facilities for the students towards online learning is insufficient.	If the support of institutions and facilities for the students towards online learning is sufficient.	If the support of institutions and facilities for the students towards online learning is sufficient.
2	[15]; [26]	Online use = 0%, fulfilling the learning regulations according to DIKTI	Online use 30% -79%, according to DIKTI learning regulations	Online use of 30% -100%. Not meeting the requirements of face-to-face learning according to DIKTI
3	[8]; [11]; [13]	Teacher and student-centred learning	Teacher- and student-centred learning	Student-centred learning
4	[14];[5]	Time to communicate with lecturers is limited to class.	The limited time to face to face with the lecturer can be filled with online discussions.	The time is longer, but there is no guidance to students, and it is not good for vocational fields.
5	[14]	The student motivation is	The student motivation is	The student motivation is

		less.	high.	high.
6	[6];[19]	HOTS formation process is very good.	HOTS formation process is quite good.	HOTS formation process is less.
7	[5][13]	Does not facilitate extensive HOT formation	Facilitates extensive HOT formation	Facilitates extensive HOT formation

Based on the results of the relevant research summary in table 1 above, the researcher chose blended learning as a learning framework with various advantages as in the blended learning column (table 1 column (d)).

Based on the results of the relevant research summary in table 1 above, the researcher chose blended learning as a learning framework with various advantages as in the blended learning column (table 1 column (d)). While the researcher proposed the framework blended learning as Fig. 1.
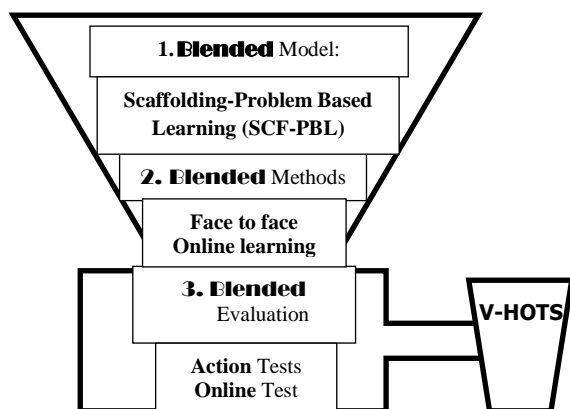

Fig. 1. The Concept of Blended Learning in Geomatics.

Figure 1. Illustrates the application of blended learning to obtain student vocational higher order thinking (V-HOT). 1) Blended model, which is by applying integration model scaffolding and problem-based learning (PBL), 2) Blended methods, namely utilizing face-to-face learning methods and online methods, and 3) Blended evaluation, namely applying action evaluation learning and evaluating online learning.

Furthermore, this research seeks to answer the question of 1) What is the role of blended learning in the formation of student HOT skills? and 2) What is the effect of blended learning on student activity?

II. RESEARCH METHODOLOGY

The approach in this investigation is qualitative research, while the model used is action research carried out on the campus of Sebelas Maret University Surakarta Indonesia. It took 6 months and involved 1 class of Land Surveying/ Geomatics learning. The participants in the research were the students who were studying Land Surveying 1 consisting of 32 students. The research was divided into the stages of analysis, design, development, implementation, and evaluation stages following the ADDIE instructional design [27]; [28]. Each step of the learning involved the use of equipment and media applied in the Edmodo program [27]. The data were collected using: observation, interview, and questionnaire.

III. BLENDED LEARNING SYNTAX

The Edmodo application is the program that can bridge differences among students in their lives and their learning process in school. Edmodo was created for 21st-century learning [31]. With the availability of this Edmodo application, the researcher who is not an IT expert found it very helpful to support online learning.

The steps in using Edmodo application for students and teachers are as follows:

Analysis:
1. The lecturer observed and asked for the model class to ensure that the students have mobile phones or laptops as the media for blended learning.
2. The lecturer made sure that the wifi was available with sufficient bandwidth.
3. Focus Group Discussion (researcher with team teaching, and researcher with senior students assistant)

Design:
The lecturer prepared lecture contracts, Semester Learning Plans (RPS), materials, questions, and answer keys divided into topics. The learning instruments were stored in Google Drive to make it easier to find and secure the files.

Development:
1. The lecturer made classes to apply classroom learning as a teacher. The students were asked to register to the group that the lecturer has made by giving an access code as a **student**.
2. One week before the lecture, the lecturer uploaded the material in the Edmodo application, it is expected that the students are motivated to learn before face-to-face lectures.

Implementation:
1. The Problem-Based Learning process, clarification, and discussion were carried out in the face to face class.
2. Material deepening, assignment of tasks, questions, and peer discussions were carried out online.

Evaluation:
1. HOT (C4-C6) formation evaluation in the form of an essay test was done face to face.
2. At the end of the semester, the students were given online-based tests. The test given was 40 multiple-choice questions distributed in halves intermittently. The allocated time was 100 minutes and after the time ran out, the Edmodo application was closed.

IV. RESULTS AND DISCUSSION

The learning process undertaken shows some of the student assessment results as follows:

1. The face-to-face test scores (essay tests) show good results with the scores above the standards set by the researcher. This is due to the fact that the students conducted discussions enthusiastically and were directly attended by the lecturer.

TABLE II.   THE ACHIEVEMENT OF FACE TO FACE STUDY

Number of participants	Number of students answering to questions	Mean Score	Deviation Standard
32	32 (100%)	82.6875	10.45

The results of learning table 2 above were obtained after students conducted field practice with the help of technology-based surveying and mapping equipment. The achievement of these values indicates that face-to-face learning is easily understood by students. In the framework of the HOT formation, the use of theodolite Total Station allows students to easily practice the field with faster and more accurate data results. The use of integrated learning between ICT-based technology, both the use of equipment and Edmodo media, which is supported by face-to-face learning, results in mutual support from one another.

2. In conjunction with online-based tests, many students are not yet familiar with the use of online tools that are more rigid in the rules, compared to the usual rules applied by lecturers at face-to-face meetings that are still tolerant. The impact of not being used in using online tools is that the students waited for each other and were hesitant to decide to upload their answers. Thus, there were 13 students who were eventually late in uploading and not getting a score (failed). This was acknowledged by one student: *"I am not used to answering online, so I am waiting for others to upload their answer together. It turns out the time is up and I can't upload my answer."*

From the sample of the student's answers, the researcher was more motivated to improve his technological knowledge in accordance with the results of the research of [28] that technology-rich learning experiences had the potential to change the educator's belief into constructivist's belief that is more student-centered.

TABLE III.   THE ACHIEVEMENT OF ONLINE LEARNING

Number of participants	Number of students answering to questions online	Mean Score	Deviation Standard
32	19 (59,38%)	67.381	6.248809

Notes: NR = Mean Score

From the results of the evaluation obtained in table 3, as well as the results of interviews with the students, the researcher made the following improvements: 1)

Evaluating the students' attitudes towards blended learning. The teacher told the students of the time tightness in the online test and gave an overview about the online test mostly applied to the admission process of new students and employees. 2) The case of the course material, the lecturer paid attention to the mistakes made by students. From the evaluation results, it was known that the biggest mistake of the students were the understanding of theodolite equipment, and the results of distance analysis. Therefore, the researcher improved the cognitive understanding of the students by enriching multimedia combination [29], the operation procedure of theodolite equipment, and guiding them in analyzing of different height calculating horizontal distances with the vertical shot of target $\neq 900$. The formula are:

$$V = 100 \ (ba - bb) \cos\theta \sin\theta \ \text{.......} \ (1)$$

Determine the height difference

$$H = 100 \ (ba - bb) \cos^2\theta \ \text{.............} \ (2)$$

Analysis of the horizontal distance

This is consistent with the result of the research of [30] that through strong scaffolding and ongoing support, each member feels valued for what he contributes.

Considering that online test cannot be done twice, the researcher remedied the face-to-face with essay questions in the form of calculation of arbitrary shooting distances. The results showed that the students passed above the standards set by the researcher (the remedial score result document was kept by the researcher). Again, the researcher investigated several students about the application of blended learning in Geomatics learning. One student answered, *"Learning using the Edmodo application makes it easier for me to know the previous material so that when learning begins, I already have the knowledge to actively participate in discussions."* To perfect the results of field investigations, the researcher distributed questionnaires containing 5 questions relating to the implementation of the blended learning application. The students do not need to wrote their name on the questionnaire to rely on their awareness to answer. There were 20 students who uploaded their answers. The results can be seen in table 2 below:

TABLE IV.   STUDENT'S ANSWERS OF QUESTIONNAIRE

No	Questions	Mean Score (%)
1	Does the lecturer prepare ICT-based learning?	75
2	Don't you always use e-learning programs prepared by the lecturer?	58
3	Do you do assignments through e-learning?	73
4	Does the material that has been uploaded to the e-learning application by the lecturer motivate you to read and understand the material?	66
5	Can the ICT developed by the lecturer be used to improve the learning process effectiveness?	72

N=32 participants

Table 4 consist of 32 participants who fill the questionnaire. it shows that the students have seen the lecturer's motivation to prepare good learning. However, the students themselves do not have the enthusiasm to use

ICT as their provision to do Geomatics assignments. Therefore, it is a challenge for the lecturer to prepare for better learning. The researcher evaluated again the existing Edmodo application and concluded that although in Edmodo application there have been many material displays, the task and interaction aspect between the lecturer and students have not been carried out well. The students have not been encouraged to upload their work results on the online application prepared by the lecturer. The results of this research indicate that blended learning has many benefits in terms of the content of the material, the learning process, and the students' attention and motivation [30].

V. CONCLUSION

The results of the research concluded that the use of ICT in the form of practical equipment, multimedia, and blended learning model has great potential in achieving high-order thinking skills (HOTS) in students. The use of ICT was also carried out to determine the students' initial competence (pretest) so that the lecturer could immediately reflect on the results of the test. The results of the research are in accordance with [31], revealed that e-learning activities support and complement face-to-face classes, and thus the combined effect has a positive impact on learning. In terms of the activeness of the student learning, it was found that the students were motivated and actively opened Edmodo and the web to do the assignments from their lecturer.

VI. SUGGESTION

This research gives recommended as following:

1. Habituation of ICT-based learning for students is an important factor to form digital age for students, and the accompanying impact is that when looking for work and working the will get used to online tests.

2. Lecturers should prepare and implement blended learning, both models, methods, and evaluation of student learning

VII. DECLARATION OF CONFLICT OF INTEREST

The author declares that there is no potential conflict of interest regarding the research and/ or publication of this article.

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